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Claims

1. Apparatus for modifying the shape of an aircraft component, the apparatus including a shaped surface so arranged that an aircraft component
5 may be forced against the shaped surface in a manner that modifies the shape of the aircraft component, wherein the apparatus further includes an intermediate member that in use receives and supports the component, is positioned between the shaped surface and the component, and deforms to a shape dependent on the shape of the shaped surface.
- 10 2. An apparatus according to claim 1, wherein the intermediate member is generally sheet-like in shape.
3. An apparatus according to claim 2, wherein the intermediate member has a constant thickness across the majority of its area.
4. An apparatus according to any preceding claim, wherein the intermediate
15 member is, prior to use of the apparatus, substantially flat.
5. An apparatus according to any preceding claim, wherein the intermediate member is such that it may repeatedly deform to substantially the same shape, that shape being dependent on the shape of the shaped surface.
6. An apparatus according to any preceding claim, wherein the shaped
20 surface is defined by an open structure, the open structure including elements separated by gaps, the shape to which the component may be modified being dependent on the shape defined by the notional smooth surface enveloping the elements and bridging the gaps, the intermediate member being sufficiently stiff that in use during the forcing of the aircraft component against the shaped
25 surface, the intermediate member deforms substantially to the shape of said notional smooth surface, but suffers substantially no local deformation in regions of the intermediate member that bridge the gaps.
7. An apparatus according to any preceding claim, wherein the intermediate
30 layer is arranged to be free to move over the shaped surface within predefined boundaries.

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8. An apparatus according to any preceding claim, wherein the apparatus is arranged such that the aircraft component is free to move in directions substantially parallel to the shaped surface.
9. An apparatus according to claim 8, wherein the apparatus is arranged
5 such that, in use, the aircraft component is prevented from moving beyond predefined boundaries.
10. An apparatus according to any preceding claim, wherein the shaped surface comprises an open structure.
11. An apparatus according to claim 10, wherein the open structure
10 comprises a multiplicity of spaced apart elements and the shape to which the component may be modified is dependent on the shape defined by a notional surface that envelopes the elements.
12. An apparatus according to any preceding claim, wherein the shaped surface is defined by a multiplicity of separate elements.
13. An apparatus according to claim 12, wherein the elements are arranged
15 in groups, each group comprising a plurality of elements, the elements in each group being mounted in fixed relation to each other.
14. An apparatus according to any of claims 11 to 13, wherein the elements are in the form of ribs.
15. An apparatus according to any of claims 11 to 14, wherein the elements
20 are removably mounted on the apparatus.
16. An apparatus according to any of claims 11 to 15, wherein the elements are fixed in position on the apparatus by means of a portion of the element that engages with a corresponding portion of the apparatus, the portions and
25 corresponding portions being shaped such that they do not restrict movement of the elements away from the apparatus.
17. An apparatus according to any preceding claim, wherein the shaped surface is rigid.

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18. An apparatus according to any preceding claim, wherein the apparatus is arranged such that the component is, in use, forced against the shaped surface by means of an air pressure difference.

19. An apparatus according to claim 18, wherein the air pressure difference
5 is at least partially provided by suction.

20. An apparatus according to claim 19, wherein the suction is provided via a bag of a bagging apparatus.

21. Apparatus for modifying the shape of an aircraft component, the apparatus including a shaped surface so arranged that an aircraft component
10 may be forced against the shaped surface in a manner that modifies the shape of the aircraft component, wherein the apparatus is arranged such that the component is, in use, forced against the shaped surface by means of an air pressure difference that is at least partially provided by suction via a bag of a bagging apparatus.

15 22. An apparatus according to claim 20 or 21, wherein the apparatus is arranged such that the bag, in use, must encompass both the aircraft component and at least a portion of the apparatus on the opposite side of the shaped surface to the aircraft component.

20 23. An apparatus according to any of claims 20 to 22, wherein the apparatus includes a base which supports the shaped surface and the apparatus is arranged such that the bag, in use, must at least partially be sealingly attached to the base.

24. An apparatus according to any of claims 20 to 23, wherein the bag is reusable.

25 25. An apparatus according to any preceding claim, wherein the apparatus is in the form of a creep-forming tool.

26. An apparatus according to any preceding claim, wherein the apparatus is arranged so that it is suitable for modifying the shape of metallic components.

27. A method of modifying the shape of an aircraft component, the method
30 including the steps of

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providing a shaped surface and an intermediate member,

forcing an aircraft component against the shaped surface, via the intermediate member, in a manner that modifies the shape of the aircraft component, and

5 removing the aircraft component.

28. A method according to claim 27, wherein immediately prior to the performance of the step of forcing the component against the shaped surface, the intermediate member is substantially flat.

29. A method according to claim 27 or claim 28, wherein the method is
10 performed a multiplicity of times and the same intermediate member is used on each occasion.

30. A method according to any of claims 27 to 29, wherein the step of forcing of the aircraft component against the shaped surface causes the aircraft component to undergo plastic deformation.

15 31. A method according to any of claims 27 to 30, wherein the method includes a step of releasing the component from the shaped surface and after the release of the component the shape of the component changes significantly.

32. A method according to any of claims 27 to 31, wherein, before
20 performance of the step of forcing of the aircraft component against the shaped surface, the aircraft component is generally flat in shape.

33. A method according to any of claims 27 to 32, wherein, during performance of the step of forcing of the aircraft component against the shaped surface, the aircraft component slides over the shaped surface within predefined boundaries.

25 34. A method according to any of claims 27 to 33, wherein the aircraft component is forced against the shaped surface by means of an air pressure difference.

35. A method of modifying the shape of an aircraft component, the method including the steps of

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providing a shaped surface, supported by a support structure,

forcing, by means of an air pressure difference, an aircraft component against the shaped surface in a manner that modifies the shape of the aircraft component, and

5 removing the aircraft component, wherein

the air pressure difference is at least partially provided by suction via a bag of a bagging apparatus, the bag encompassing both the aircraft component and at least a portion of the support structure on the opposite side of the shaped surface to the aircraft component.

10 36. A method according to claim 35, wherein the shape of a further aircraft component is modified by performing the method with the use of the same bag.

37. A method of creep forming a metallic component including using the apparatus of any of claims 1 to 26, or performing the steps of the method of any of claims 27 to 36.

15 38. An aircraft component formed by use of an apparatus according to any of claims 1 to 26, or from performance of a method according to any of claims 27 to 36.

39. An aircraft including an aircraft component according to claim 38.